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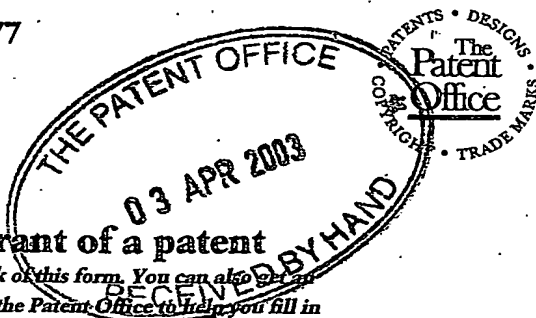
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Dated 7 May 2004



1/77  
04APR03 E797635-9 002224  
P01/7700 0.00-0302746.8

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference

WBH/M13

2. Patent application number

(The Patent Office will fill in this part)

0307746.8

03 APR 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

MicroEmissive Displays Limited  
Scottish Microelectronics Centre,  
The King's Buildings,  
West Mains Road,  
Edinburgh  
EH9 3JF

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

REMOVING A MATERIAL FROM A SUBSTRATE

5. Name of your agent (if you have one)

J.Y. & G.W. Johnson

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kingsbourne House,  
229-231 High Holborn,  
London WC1V 7DP

Patents ADP number (if you know it)

976001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d).

# Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 4

Claim(s) 2

Abstract 

Drawing(s) 1 + 1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

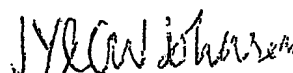
Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature



Date 3.4.03

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr William Hanson  
020 7405 0356

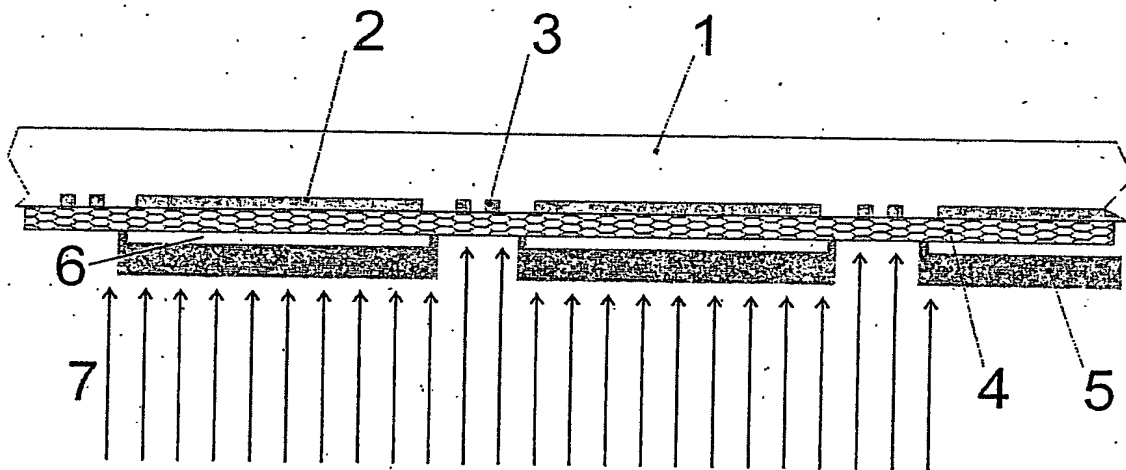
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## REMOVING A MATERIAL FROM A SUBSTRATE

### Background to the Invention

The present invention relates to a method of selectively removing a  
5 polymeric material from a substrate in order to leave the material on the  
substrate in a defined pattern only.

Any such method must not damage the bulk or interface of the polymeric  
material that is required. Thus, in general, photolithography cannot be used.

10

A particular application of the method is in the formation of arrays of  
organic light emitting diode (OLED) pixels. Layers of polymeric material  
may be required in such pixels, for example, light emitting polymers  
themselves or layers of electrically conducting polymer forming part of an  
15 electrode. It is known to form the layers in a desired pattern by coating an  
entire area of the substrate with the polymeric material and then removing  
the material from those regions where it is not required. One known  
removal method is to use laser photoablation. However, a disadvantage of  
laser photoablation is that particles of removed material thrown up by the  
20 photoablation process tend to fall back on to the substrate at unwanted  
locations.

### Summary of the Invention

With the aim of alleviating these disadvantages, the present invention  
25 provides a method of removing a polymeric material from defined areas of a  
substrate comprising the steps of arranging a shadow mask to overlie the  
polymeric material other than in the defined areas, and applying a beam of  
ions to the defined areas through the mask.

In a particular embodiment of the invention, in order to prevent damage by the mask of particular areas of the polymeric material, at least one of the mask and the substrate has recesses in its surface facing the other of the mask and the substrate.

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The ions may be chemically reactive with the polymeric material to be etched in order to selectively etch the polymer and increase etch rate. The ions may be ions of a normally inert gas such as Argon.

- 10 The method may be carried out in a vacuum such that the removed polymeric material does not redeposit on the substrate. In particular, the pressure may be such that the mean free path of the ions is greater than or equivalent to the dimensions of the chamber in which the method is performed so that the process is collision free. For example, the pressure  
15 may be less than  $5 \times 10^{-4}$  mbar.

The polymeric material may comprise at least one polymeric layer of an array of organic light emitting diodes to be formed on the substrate. For example, the polymeric material to be removed may be that covering a bond  
20 pad region of the substrate.

Another embodiment of the inventive method comprises a method of removal of at least one organic light emitting diode pixel from an array of organic light emitting diode pixels. This is useful in circumstances in which  
25 a pixel is found to be faulty and requires replacement.

#### Brief Description of the Drawing

In order that the invention may be more readily understood, the invention will now be described in more detail, by way of example only, with reference  
30 to the accompanying drawing, the single figure of which shows in schematic

section a substrate undergoing removal of polymeric material according to an embodiment of the invention.

#### Detailed Description of a Particular Embodiment

5 The drawing shows a substrate 1, such as a silicon substrate defining active circuitry (not shown) for controlling an array of OLED pixels 2. Bond pads 3 are located between the arrays 2. A layer of polymeric material 4 has been coated over the entire substrate 1 and it is desired to remove the polymeric material from the region of the bond pads 3 but not from the arrays 2.

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A hard shadow mask 5 having openings corresponding to the regions of the bond pads 3 is placed on the substrate 1. In order to avoid scraping or gouging of the desired polymeric material 4 by the mask 5, the latter has recesses 6 so that it does not actually contact the polymeric material in the region of the arrays 2.

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A beam 7 of Argon ions accelerated from a plasma in a chamber is then caused to impinge on the masked substrate 1. The beam can be spatially neutralised to reduce the static charging of the substrate by use of a neutralising beam of electrons emitted from a cathode. The spatially neutral ion beam removes the polymeric material in the regions of the bond pads 3 but not in the masked regions. The vacuum under which the process is operated is such that the unwanted removed polymeric material is deposited on the walls of the vacuum system. The vacuum system is typically under sufficiently reduced pressure such that there are no collisions between individual gas ions within the ion beam and as a consequence the etching effect of the beam is directional.

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The invention could also be used in the repair of large scale OLED pixel arrays, i.e. those fabricated by ink-jet printing go the pixels. By aligning a

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suitable mask, polymeric material could be removed from such arrays and replaced at an early stage in the fabrication of a product. Preferably, faulty pixels would be identified and repaired without activation ("lighting up") of the array.

All forms of the verb "to comprise" used in this specification have the meaning "to consist of or include".



## CLAIMS

1. A method of removing a polymeric material from defined areas of a substrate comprising the steps of arranging a shadow mask to overlies the polymeric material other than in the defined areas, and applying a beam of ions to the defined areas through the mask.
2. A method according to claim 1 or 2, wherein at least one of the mask and the substrate has recesses in its surface facing the other of the mask and the substrate.
3. A method according to claim 1, 2 or 3, wherein the ions are chemically reactive with the polymeric material to be etched.
4. A method according to any preceding claim, wherein the ions are ions of a normally inert gas.
5. A method according to claim 4, wherein the ions are Argon ions.
6. A method according to any preceding claim, wherein the step of applying the beam of ions is carried out in a chamber having dimensions, at a pressure at which the mean free path of the ions is greater than or equivalent to the chamber dimensions.
7. A method according to any preceding claim wherein the step of applying the beam of ions is carried out at a pressure less than  $5 \times 10^{-4}$  mbar.
8. A method according to any preceding claim, wherein the polymeric material is formed from a polymeric layer of an array of organic light emitting diodes on the substrate.

9. A method according to claim 8, wherein the polymeric material to be removed covers a bond pad region of the substrate.
10. A method according to claim 8, comprising removal of polymeric material from at least one organic light emitting diode pixel of the array of organic light emitting diode pixels.